SUMMARY:

The Permanente Creek Hydrology was re-examined and updated to reflect new changes made on two sub basins and to respond to internal and external stakeholder's requests for checking the design flows. The new changes include a quarry area over 230 acres as a mining site which is excluded with the understanding that this area will not contribute flow to the creek downstream; and with one upper watershed sub basin rainfall adjusted to match with the adjacent sub-basins. Through calibration process of historical events, the watershed parameters are recalculated. Applying these changes to the hydrology model, following the District's Hydrology Procedures, the 10% and 1% design flows at the Diversion point are 1,300 cfs and 2,400 cfs, respectively.

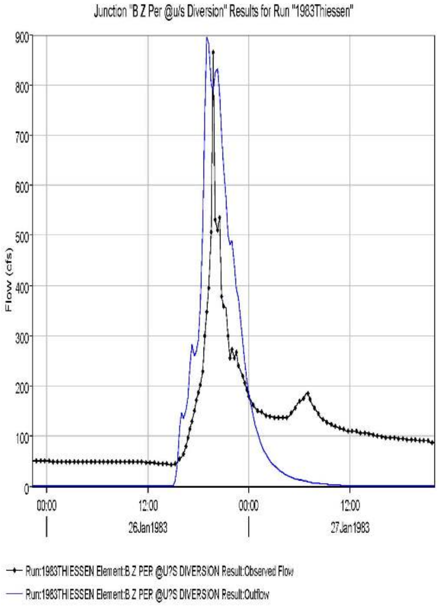
ANALYSIS:

The Permanente Creek drains a total area of about 16.5 square miles, a quarry with its size over 230 acres (0.36 sq. mi.) in the Lower Permanente watershed does not contribute flows to the downstream of the creek. Therefore, the hydrology model was updated for a total drainage area of 16.2 square miles. The analysis follows the District's Rainfall-Runoff modeling Hydrology Procedures with the use of regional regressed 10% and 1% precipitation data as the input, applying the Clark's Synthetic Unit Hydrograph method using the U. S. Army Corps of Engineers Hydrologic Modeling System software package HEC-HMS with SCS loss rate and channel/reservoir routings to obtain the updated design flows.

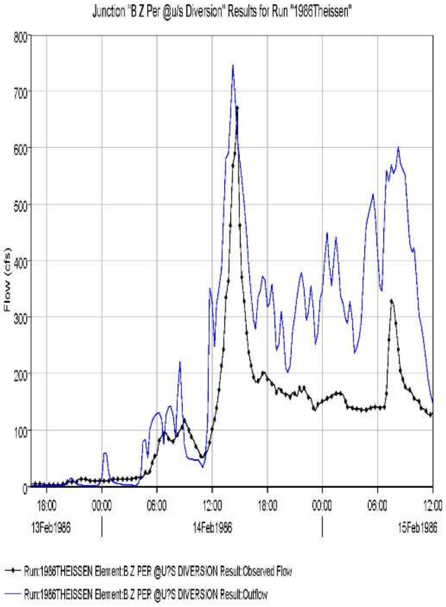
A. Calibration:

The calibration of the historical events for both the Permanente Creek at Berry Avenue (Station 32A) and the Hale Creek at Fremont Avenue (Station 33) were performed to obtain Clark's parameters Tc & R with the watershed Antecedent Moisture Conditions (AMC). The calibration results are shown below:

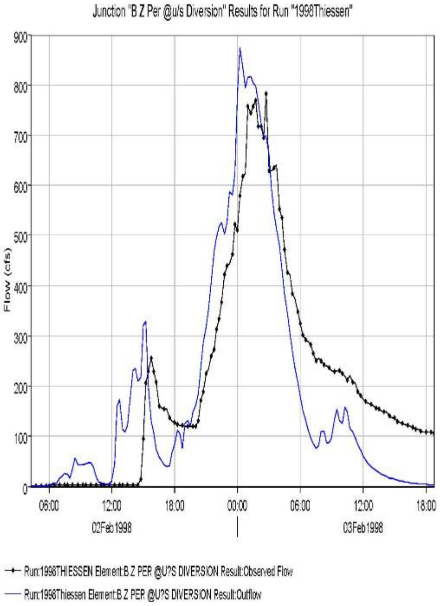
For Permanente Creek at Berry Avenue



January 1983 event

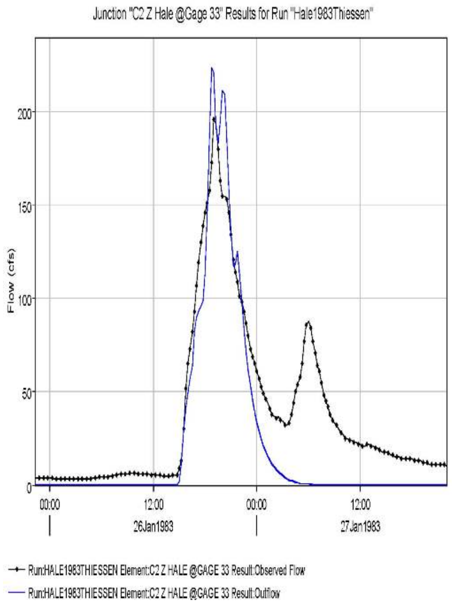


February 1986 event

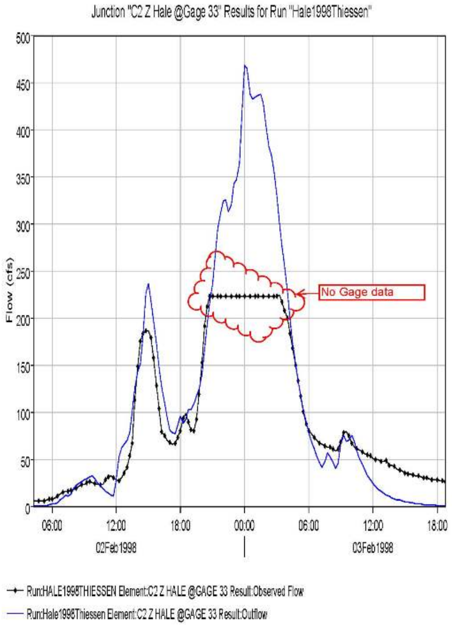


February 1998 event

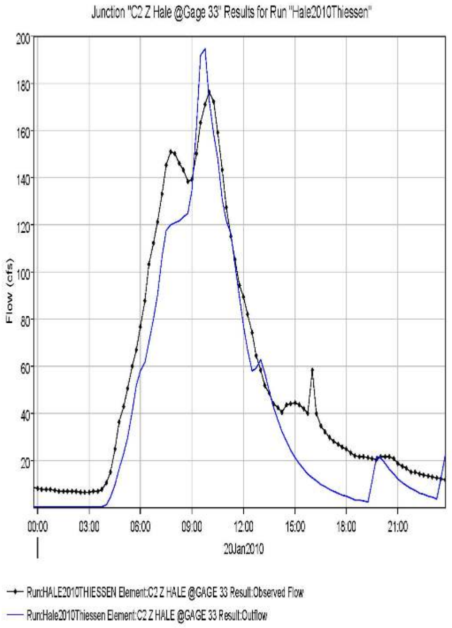
For Hale Creek at Fremont Avenue



January 1983 event



February 1998 event



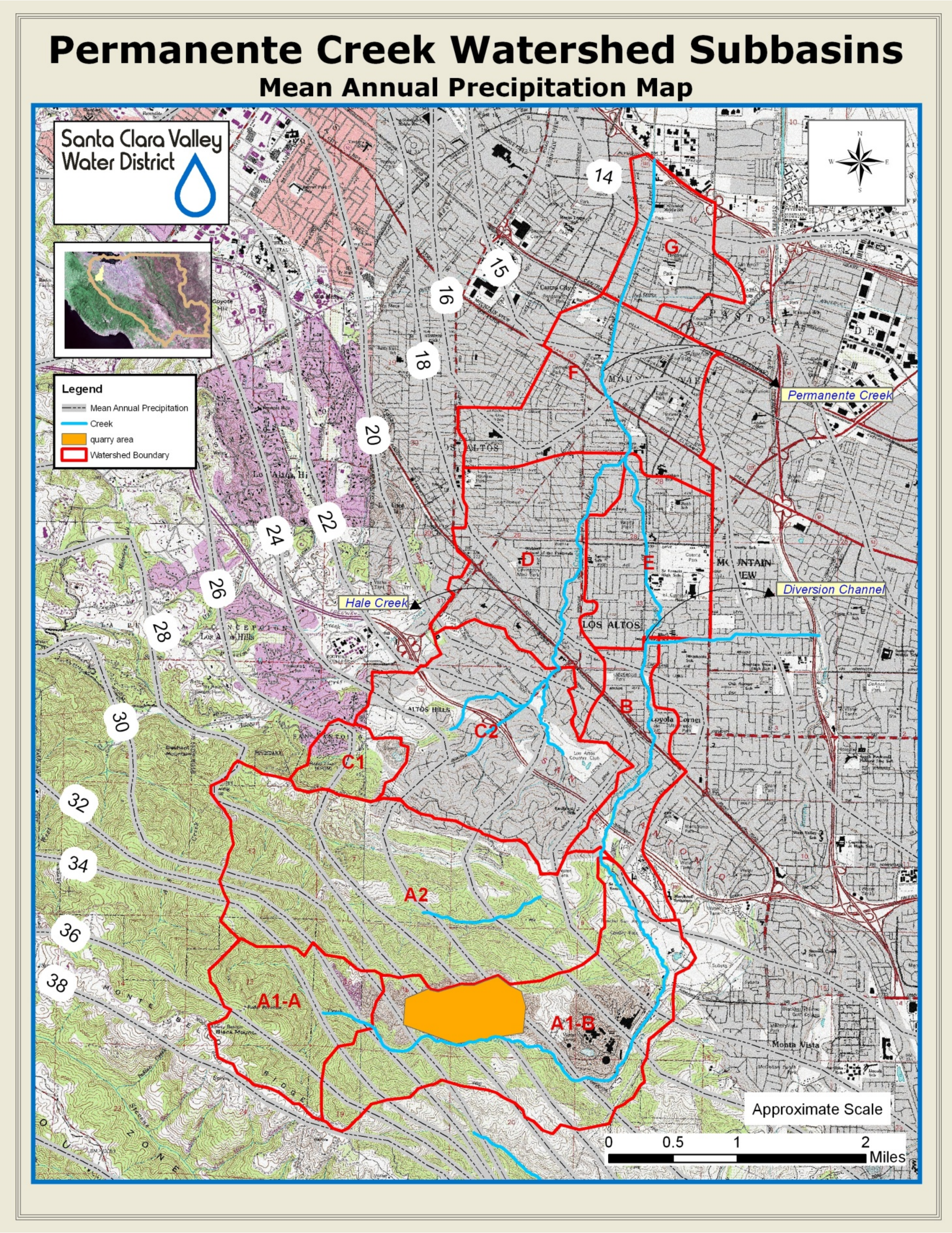
January 2010 event

The above graphs illustrate that the observed data and the model simulated results are in good agreement for the historical events selected.

B. Design Flows

The procedures applied to obtain the design flows are described below:

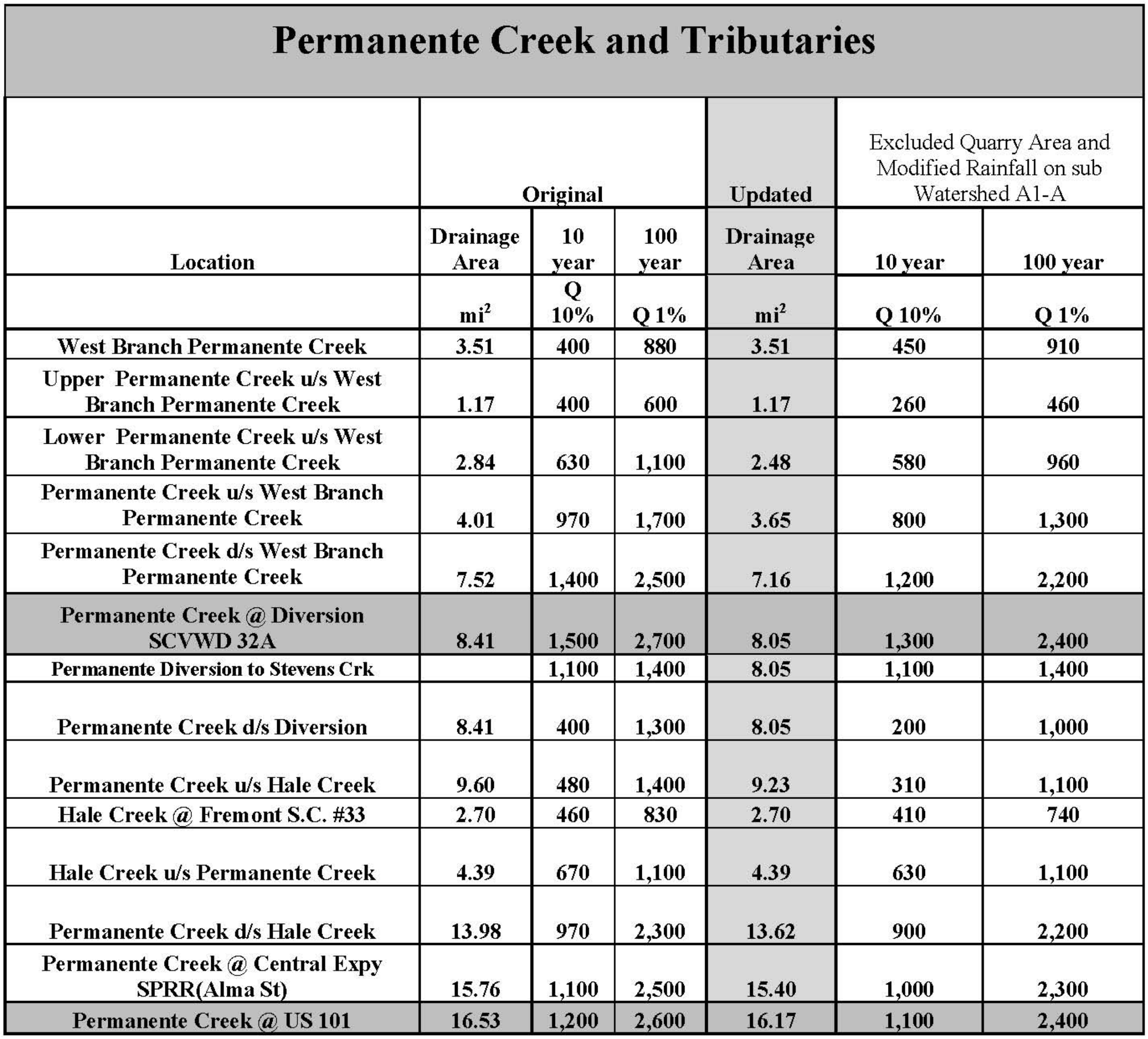
The total watershed drainage area is about 16.2 square miles with 0.36 square miles of mining quarry area (within sub basin A1-B, shown below) excluded from the hydrology model. The regional regressed precipitation amount for the very upstream sub basin A1-A showed a much higher value compared to its adjacent sub basins. The splitting of sub area A1 into two sub basins A1-A and A1-B is due to project needs for possible detention basin study. As a result of dividing the area, the Mean Annual Precipitation (MAP) for the sub area A1-A, located at a higher Mean Annual Precipitation (MAP) zone, is about 36 inches versus about 26 inches for the adjacent sub basins A1-B or A2. An adjustment of the precipitation amount was made by adopting the rainfall at sub basin A1-B (or A2) to smooth out the point rainfall value at sub basin A1-A. The hydrology model simulations yielded results of 1,300 cfs and 2,400 cfs at the Permanente Diversion and 1,100 cfs and 2,400 cfs at the Permanente Creek @ Hwy 101, for the 10% and 1% flows, respectively.



Permanente Creek Watershed Subbasins

Mean Annual Precipitation Map

The final Design Flows for the 10% and 1% for the original and updated cases are tabulated as follows:



Permanente Creek and Tributaries

	Original			Updated	Excluded Quarry Area and Modified Rainfall on sub Watershed A1-A	
Location	**Drainage Area**	**10 year**	**100 year**	**Drainage Area**	**10 year**	**100 year**
	mi^2	**Q 10%**	**Q 1%**	**mi^2**	**Q 10%**	**Q 1%**
West Branch Permanente Creek	**3.51**	**400**	**880**	**3.51**	**450**	**910**
Upper Permanente Creek u/s West Branch Permanente Creek	**1.17**	**400**	**600**	**1.17**	**260**	**460**
Lower Permanente Creek u/s West Branch Permanente Creek	**2.84**	**630**	**1,100**	**2.48**	**580**	**960**
Permanente Creek u/s West Branch Permanente Creek	**4.01**	**970**	**1,700**	**3.65**	**800**	**1,300**
Permanente Creek d/s West Branch Permanente Creek	**7.52**	**1,400**	**2,500**	**7.16**	**1,200**	**2,200**
Permanente Creek @ Diversion SCVWD 32A	**8.41**	**1,500**	**2,700**	**8.05**	**1,300**	**2,400**
Permanente Diversion to Stevens Crk		**1,100**	**1,400**	**8.05**	**1,100**	**1,400**
Permanente Creek d/s Diversion	**8.41**	**400**	**1,300**	**8.05**	**200**	**1,000**
Permanente Creek u/s Hale Creek	**9.60**	**480**	**1,400**	**9.23**	**310**	**1,100**
Hale Creek @ Fremont S.C. #33	**2.70**	**460**	**830**	**2.70**	**410**	**740**
Hale Creek u/s Permanente Creek	**4.39**	**670**	**1,100**	**4.39**	**630**	**1,100**
Permanente Creek d/s Hale Creek	**13.98**	**970**	**2,300**	**13.62**	**900**	**2,200**
Permanente Creek @ Central Expy SPRR(Alma St)	**15.76**	**1,100**	**2,500**	**15.40**	**1,000**	**2,300**
Permanente Creek @ US 101	**16.53**	**1,200**	**2,600**	**16.17**	**1,100**	**2,400**

DISCUSSIONS:

From the above table, it is evident that exclusion of quarry area and with the adjustment on the rainfall for one upper sub basin would reduce the design flows at both catch points – Permanente Creek at the Diversion point and at Hwy 101. It is recommended that the Project Team adopt the updated design flows for project use.